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Examiner: Harlan

Signature

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directly affect, be directly affected by or have a bearing on the Board's decision in the pending appeal.

### **Status of Claims**

Claims 1-36 are pending in the application and were originally presented in the application. Claims 1-36 stand rejected under 35 U.S.C. §103(a). The rejection of the pending claims is appealed. The pending claims are shown in the attached Appendix A.

### **Status of Amendments**

No amendments have been made to the pending claims.

### **Summary of the Invention**

Embodiments of the invention generally relate to the polymerization of ethylene employing bis-imino pyridinyl transition metal catalyst components of  $C_2$ ,  $C_{2v}$  and  $C_s$  symmetry to control polymer yield and molecular weight. *See*, specification, at least paragraph 1.

Unexpectedly, selection of the symmetry of the catalyst component (determined by  $B_1$  and  $B_2$ ) can be used to effect changes in molecular weight of the polymer product. For example, molecular weight can be controlled by changes in the aromaticity of the groups  $B_1$  and  $B_2$ . *See*, specification, at least paragraphs 73-74.

### **Issue Presented**

Whether the Examiner erred in rejecting claims 1-36 under 35 U.S.C. §103(a) as being unpatentable over European Patent No. 1,125,928 (*Watanabe*) on grounds that *Watanabe* does not teach, show or suggest a transition metal catalyst having  $B_1$  and  $B_2$  as recited in the pending claims.

## Arguments

### **THE EXAMINER ERRED IN REJECTING CLAIMS 1-36 UNDER 35 U.S.C. §103(a) AS BEING UNPATENTABLE OVER *WATANABE* BECAUSE *WATANABE* DOES NOT SHOW OR SUGGEST B<sub>1</sub> AND B<sub>2</sub>.**

Applicants personally interviewed the pending claims with the Examiner's Primary on May 3<sup>rd</sup>, 2005, where he concurred with the Applicants' argument that the *Watanabe* does not teach, show or suggest that catalyst recited in the pending claims. See, Interview Summary dated September 28, 2004. However, the Examiner issued a Final Rejection on July 26, 2005.

The Final Rejection states that *Watanabe* expressly states R<sub>6</sub> to R<sub>15</sub> of Formula I may be bonded to each other to form a ring. See, Final Rejection at page 3, first paragraph. The Examiner further states that such modification would be obvious because one would have a reasonable expectation of success that complexes and process for preparing the complexes as taught by *Watanabe* would be similarly useful and applicable to use in preparing ethylene polymers. See, *Id.* at page 4, first paragraph.

Applicants submit that the Examiner has not provided a prima facie case of obviousness. *Watanabe* does teach, show or suggest a catalyst component having substituent groups B<sub>1</sub> and B<sub>2</sub>, as recited in the pending claims. For example, *Watanabe* does not reasonably suggest a catalyst having C<sub>2</sub> symmetry and wherein B<sub>1</sub> and B<sub>2</sub> are the same and are a 1-naphthyl group, a substituted 1-naphthyl group or an anthracenyl group or C<sub>s</sub> symmetry wherein B<sub>1</sub> is a phenyl or substituted phenyl group and B<sub>2</sub> is different from B<sub>1</sub> and is a polyphenyl group or terphenyl group.

First, the Examiner has not demonstrated that there is a reasonable suggestion to modify the teachings of *Watanabe* to form the claimed features. *Watanabe* fails to show the equivalence between the specific components claimed and the statement in the prior art (*i.e.*, that R<sub>6</sub> to R<sub>15</sub> may be bonded to one another to form a ring.) Accordingly, the teachings lack a firm basis to predict the effect of the proposed interchange. See, *Ex parte Koo*, 150 U.S.P.Q. 131 (Bd. Pat. App. 1965) at 132.

Second, the Examiner has not demonstrated a reasonable expectation of success. "[T]he Examiner must show reasons that the skilled artisan, confronted with the same problems as the inventor and with no knowledge of the claimed invention, would select

the elements from the cited prior art references for combination in the manner claimed.”  
*See, In re Rouffet*, 149 F.3d 1350, 47 U.S.P.Q.2d at 1458.

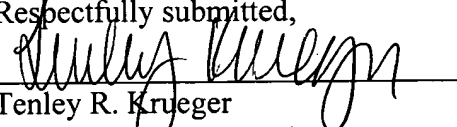
The Examiner states that such modification would be obvious because one would have a reasonable expectation of success that complexes and process for preparing the complexes as taught by Watanabe would be similarly useful and applicable to use in preparing ethylene polymers. *See*, Final Office Action at page 4, first paragraph. However, Applicants submit that the expectation of success in the present application is not whether the catalyst is capable of producing polyethylene, but whether such modification would produce a catalyst capable of molecular weight control.

Accordingly, Applicants respectfully request reversal of the rejection.

### Conclusion

In conclusion, *Watanabe* nowhere teaches or suggests B<sub>1</sub> and B<sub>2</sub>, as recited in the pending claims. Thus, Applicants respectfully request reversal of the rejections of claims 1-36.

Respectfully submitted,



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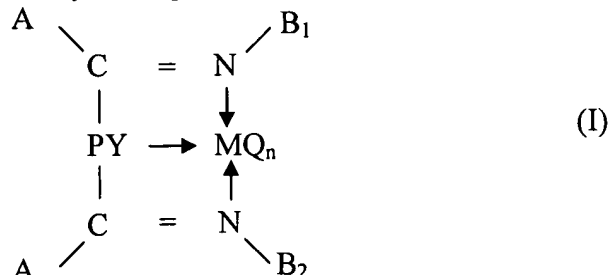
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Attorney for Applicant(s)

## Appendix A

### Pending Claims

1. An ethylene polymerization process comprising:  
providing a transition metal catalyst component characterized by the formula:



wherein M is a transition metal selected from Groups 4-11 of the Periodic Table of Elements; n is an integer of from 1 – 3; Q is a halogen or a C<sub>1</sub> – C<sub>2</sub> alkyl group; PY is a pyridinyl group, which is coordinated with M through the nitrogen atom of said pyridinyl group; A is a methyl group, a phenyl group, or a substituted phenyl group;

wherein: said catalyst component has C<sub>2</sub> symmetry and B<sub>1</sub> and B<sub>2</sub> are the same and are a 1-naphthyl group, a substituted 1-naphthyl group, a 5,6,7,8-tetrahydro-1-naphthyl group or an anthracenyl group; or said catalyst component exhibits C<sub>2v</sub> symmetry and B<sub>1</sub> and B<sub>2</sub> are the same and are a phenyl group or a substituted phenyl group; or said catalyst exhibits C<sub>s</sub> symmetry and B<sub>1</sub> is a phenyl or substituted phenyl group and B<sub>2</sub> is different from B<sub>1</sub> and is a polyphenyl group or terphenyl group,

providing an activating co-catalyst component;

contacting said catalyst component and said co-catalyst component with ethylene in a polymerization reaction zone which is free of hydrogen or contains hydrogen in an amount which is less than 5 mol% of said ethylene under polymerization conditions to produce a polymer product by the polymerization of said ethylene; and

recovering said polymer product from said reaction zone.

2. The process of claim 1 wherein said polymer product is an ethylene homopolymer.

3. The process of claim 1 wherein said catalyst component and said co-catalyst component are contacted in said polymerization reaction zone with ethylene and a  $C_{3+}$  alpha olefin to produce a copolymer of ethylene and said  $C_{3+}$  alpha olefin.
4. The process of claim 3 wherein said  $C_{3+}$  alpha olefin is propylene.
5. The process of claim 1 wherein said catalyst component comprises a mixture of two catalyst subcomponents, one of which exhibits  $C_2$ ,  $C_{2v}$  or  $C_s$  symmetry and the other of which exhibits  $C_2$ ,  $C_{2v}$  or  $C_s$  symmetry which is different from the symmetry of said first catalyst subcomponent.
6. The process of claim 1 wherein said catalyst component exhibits  $C_2$  symmetry and produces a polymer of lower molecular weight than the polymer produced by a corresponding catalyst component of  $C_2$  symmetry in which the substituents A are of a higher molecular weight than the substituents A of said catalyst component or in which the groups  $B_1$  and  $B_2$  are less aromatic than the groups  $B_1$  and  $B_2$  of said catalyst component.
7. The process of claim 1 wherein said catalyst component exhibits  $C_s$  symmetry and produces a polymer of higher molecular weight than the polymer produced by a corresponding catalyst component of  $C_s$  symmetry in which at least one of the groups  $B_1$  and  $B_2$  is less bulky than corresponding group  $B_1$  or  $B_2$  of said catalyst component.
8. The process of claim 1 wherein said catalyst component exhibits  $C_{2v}$  symmetry and produces a polymer of higher molecular weight than the polymer produced by a corresponding catalyst component of  $C_{2v}$  symmetry in which the substituents A are of a lower molecular weight than the substituents A of said catalyst component.
9. The process of claim 1 wherein said catalyst component exhibits  $C_2$  symmetry and the polymer product has a lower molecular weight than the polymer product

produced by polymerization under the same polymerization conditions with a catalyst component having  $C_s$  or  $C_{2v}$  symmetry.

10. The process of claim 1 wherein said catalyst component exhibits  $C_s$  symmetry and the polymer produced by the polymerization of said monomer in said reaction zone has a molecular weight which is greater than the molecular weight of the polymer product produced by polymerization under the same polymerization conditions with a catalyst component having  $C_2$  symmetry.

11. The process of claim 1 wherein said catalyst component exhibits  $C_{2v}$  symmetry and said polymerization reaction zone is operated under conditions to produce a polymer product having a molecular weight greater than that produced by operation of the reaction zone under corresponding conditions with a catalyst having  $C_s$  symmetry.

12. The process of claim 1 wherein hydrogen is introduced into said reaction zone in an amount effective to increase the activity of said catalyst component relative to the activity of said catalyst component without the introduction of hydrogen.

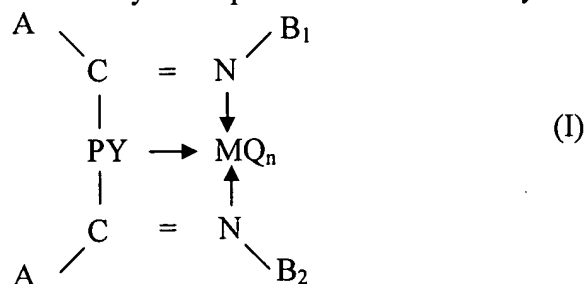
13. The process of claim 11 wherein said hydrogen is introduced in an amount to provide a hydrogen/ethylene mole ratio within the range of 0.001 – 0.02.

14. The process of claims 1 wherein 1-hexene is introduced into said reaction zone in an amount effective to decrease the molecular weight of said polymer product relative to the polymer product produced by the polymerization of said ethylene in the absence of hexene.

15. The process of claim 1 wherein hydrogen and hexene are introduced into said polymerization reaction zone along with said ethylene.

16. The process of claim 1 wherein M is a transition metal selected from Groups 8-10 of the Periodic Table of Elements.

17. The process of claim 16 wherein M is iron or cobalt and n is 2.
18. The process of claim 17 wherein M is iron.
19. The process of claim 18 wherein Q is chlorine or bromine.
20. The process of claim 19 wherein Q is chlorine.
21. The process of claim 20 wherein the activating co-catalyst is an alkylalumoxane.
22. An ethylene polymerization process comprising:  
providing a first transition metal catalyst component characterized by the formula:



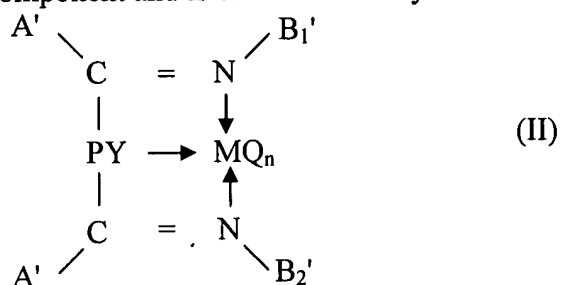
wherein M is a transition metal selected from Groups 4-11 of the Periodic Table of Elements; n is an integer of from 1 – 3; Q is a halogen or a C<sub>1</sub> – C<sub>2</sub> alkyl group; PY is a pyridinyl group, which is coordinated with M through the nitrogen atom of said pyridinyl group; A is a methyl group, a phenyl group, or a substituted phenyl group; wherein: said first catalyst component has C<sub>2</sub> symmetry and B<sub>1</sub> and B<sub>2</sub> are the same and are a 1-naphthyl group, a substituted 1-naphthyl group, a 5,6,7,8-tetrahydro-1-naphthyl group or an anthracenyl group; or said first catalyst component exhibits C<sub>2v</sub> symmetry and B<sub>1</sub> and B<sub>2</sub> are the same and are a phenyl group or a substituted phenyl group; or said first catalyst exhibits C<sub>s</sub> symmetry and B<sub>1</sub> is a phenyl or substituted phenyl group and B<sub>2</sub> is different from B<sub>1</sub> and is a polyphenyl group or terphenyl group,  
providing a first activating co-catalyst component;



contacting said catalyst component and said co-catalyst component with ethylene in a polymerization reaction zone under polymerization conditions to produce a first polymer product by the polymerization of said ethylene;

recovering said first polymer product from said reaction zone;

providing a second transition metal catalyst component which is different than said first transition metal catalyst component and is characterized by the formula:



wherein M is a transition metal selected from Groups 4-11 of the Periodic Table of Elements; n is an integer of from 1 – 3; Q is a halogen or a C<sub>1</sub> – C<sub>2</sub> alkyl group; PY is a pyridinyl group, which is coordinated with M through the nitrogen atom of said pyridinyl group; A' is a methyl group, a phenyl group, or a substituted phenyl group;

wherein: said second catalyst component has C<sub>2</sub> symmetry and B<sub>1</sub>' and B<sub>2</sub>' are the same and are a 1-naphthyl group, a substituted 1-naphthyl group, a 5,6,7,8-tetrahydro-1-naphthyl group or an anthracenyl group; or said second catalyst component exhibits C<sub>2v</sub> symmetry and B<sub>1</sub>' and B<sub>2</sub>' are the same and are a phenyl group or a substituted phenyl group; or said second catalyst component exhibits C<sub>s</sub> symmetry and B<sub>1</sub>' is a phenyl or substituted phenyl group and B<sub>2</sub>' is different from B<sub>1</sub>' and is a polyphenyl group or terphenyl group; providing a second activating co-catalyst component which may be the same as or different from said first co-catalyst component;

contacting said second catalyst component and said second co-catalyst component with ethylene in a polymerization reaction zone under polymerization conditions to produce a second polymer product by the polymerization of said ethylene, said second polymer product having a different molecular weight characteristic than said first polymer product; and

recovering said second polymer product from said reaction zone.

23. The process of claim 22 wherein said first catalyst component has C<sub>2</sub> symmetry and said second catalyst component has C<sub>s</sub> or C<sub>2v</sub> symmetry to produce said second polymer which has a higher molecular weight than said first polymer product.

24. The process of claim 22 wherein said first catalyst component has C<sub>2</sub> or C<sub>s</sub> symmetry and said second catalyst component has C<sub>2v</sub> symmetry to produce said second polymer product which has a higher molecular weight than said first polymer product.

25. The process of claim 22 wherein said first and second catalyst components each have C<sub>2</sub> symmetry and wherein the substituent A' of said second catalyst component is bulkier than the substituent A of said first catalyst component to produce a second polymer product which has a lower molecular weight than the molecular weight of said first polymer product.

26. The process of claim 22 wherein said first catalyst component and said second catalyst component each have C<sub>2</sub> symmetry and said group B<sub>1</sub>' and B<sub>2</sub>' of said second catalyst component has a lower aromaticity than the groups B<sub>1</sub> and B<sub>2</sub> to produce a second polymer having a lower molecular weight than the molecular weight of said first polymer product.

27. The process of claim 22 wherein said first and second catalyst components each have C<sub>2v</sub> symmetry and the substituent A' of said second catalyst component is bulkier than the substituent A of said first catalyst component to produce a second polymer product which has a higher molecular weight than the molecular weight of said first polymer product.

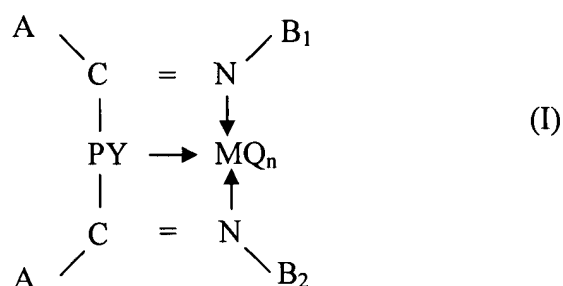
28. The process of claim 22 wherein said first catalyst component and said second catalyst component each have C<sub>s</sub> symmetry and said group B<sub>1</sub>' of said second catalyst component has a bulk which is greater than the group B<sub>1</sub> of said first catalyst component

to produce a second polymer product which has a higher molecular weight than the molecular weight of said first polymer product.

29. The process of claim 22 wherein said first catalyst component and said second catalyst component each have Cs symmetry and said group B<sub>2</sub>' of said second catalyst component has a bulk which is greater than the group B<sub>2</sub> of said first catalyst component to produce a second polymer product which has a higher molecular weight than the molecular weight of said first polymer product.

30. An ethylene polymerization process comprising:

(a) providing a first transition metal catalyst component characterized by the formula:



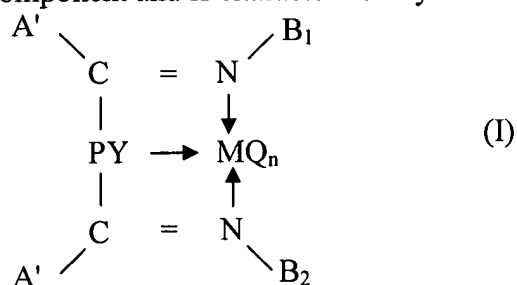
wherein M is a transition metal selected from Groups 4-11 of the Periodic Table of Elements; n is an integer of from 1 – 3; Q is a halogen or a C<sub>1</sub> – C<sub>2</sub> alkyl group; PY is a pyridinyl group, which is coordinated with M through the nitrogen atom of said pyridinyl group; A is a methyl group, a phenyl group, or a substituted phenyl group;

wherein: said first catalyst component has C<sub>2</sub> symmetry and B<sub>1</sub> and B<sub>2</sub> are the same and are a 1-naphthyl group, a substituted 1-naphthyl group, a 5,6,7,8-tetrahydro-1-naphthyl group or an anthracenyl group; or said first catalyst component exhibits C<sub>2v</sub> symmetry and B<sub>1</sub> and B<sub>2</sub> are the same and are a phenyl group or a substituted phenyl group; or said first catalyst exhibits Cs symmetry and B<sub>1</sub> is a phenyl or substituted phenyl group and B<sub>2</sub> is different from B<sub>1</sub> and is a polyphenyl group or terphenyl group, providing a first activating co-catalyst component;

contacting said catalyst component and said co-catalyst component with ethylene in a polymerization reaction zone under polymerization conditions to produce a first polymer product by the polymerization of said ethylene;

recovering said first polymer product from said reaction zone;

providing a second transition metal catalyst component which is different than said first transition metal catalyst component and is characterized by the formula:



wherein M is a transition metal selected from Groups 4-11 of the Periodic Table of Elements; n is an integer of from 1 – 3; Q is a halogen or a C<sub>1</sub> – C<sub>2</sub> alkyl group; PY is a pyridinyl group, which is coordinated with M through the nitrogen atom of said pyridinyl group; A' is a methyl group, a phenyl group, or a substituted phenyl group;

wherein: said second catalyst component has C<sub>2</sub> symmetry and B<sub>1</sub>' and B<sub>2</sub>' are the same and are a 1-naphthyl group, a substituted 1-naphthyl group, a 5,6,7,8-tetrahydro-1-naphthyl group or an anthracenyl group; or said second catalyst component exhibits C<sub>2v</sub> symmetry and B<sub>1</sub>' and B<sub>2</sub>' are the same and are a phenyl group or a substituted phenyl group; or said second catalyst component exhibits C<sub>s</sub> symmetry and B<sub>1</sub>' is a phenyl or substituted phenyl group and B<sub>2</sub>' is different from B<sub>1</sub>' and is a polyphenyl group or terphenyl group, provided that said second catalyst component exhibits a different symmetry than said first catalyst component;

providing an activating co-catalyst component;

introducing ethylene, said first and second catalyst components, and at least one activating co-catalyst component into a polymerization reaction zone and operating said reaction zone under polymerization conditions to produce a polymer product by the polymerization of said ethylene; and

recovering said second polymer product from said reaction zone.

31. The process of claim 30 wherein said first and second catalyst components are introduced into said polymerization reaction zone in a mixture of said first and second catalyst components.

32. The process of claim 30 wherein said first and second catalyst components are introduced into said polymerization reaction zone sequentially to produce two different polymer products.

33. A polymer product produced by the process of claim 1.

34. The polymer product of claim 32 comprising an ethylene homopolymer or an ethylene alphaolefin copolymer.

35. An article of manufacture formed from the polymer product of claim 34 where said product is a product produced by injection molding, a product produced by blow molding, or a product produced by extrusion.

36. The article of claim 35 comprising a film produced by extrusion molding.

## **Appendix B**

### *Evidence*

1. *Ex parte Koo*, 150 U.S.P.Q. 131 (Bd. Pat. App. 1965.)
2. *In re Rouffet*, 149 F.3d 1350, 47 U.S.P.Q.2d.

